BULLETIN
ENGINEERING DEPARTMENT
NATIONAL LAMP WORKS
OF GENERAL ELECTRIC CO.

April 20, 1915

Bulletin 24

Outdoor Tennis Court Lighting

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THE lighting of an outdoor tennis court presents a problem which is in several respects unique. The conditions to be met differ from those in other forms of outdoor lighting in that there is no fixed working plane which may be used as a basis for illumination calculations. The light must cover not only the court and the ground in the immediate vicinity but it must fill the whole space through which a ball is likely to travel while in play. Since there are no walls or roof to reflect the light, it is necessary to depend, to a great extent, upon the direct illumination of the units; and furthermore, since the blinding effect of a brilliant source is greatly intensified when the source is viewed against a black background, it becomes extremely important to locate the units outside the normal visual field. The action on a tennis court is unusually rapid and the illumination must be steady and uniform or otherwise swift motion will appear jerky and irregular. All sharp shadows which might cause a player to misjudge either the ball or the ground must be avoided by supplying light from several angles. It is not necessary to provide direct illumination above 20 to 25 feet from the ground, for balls which rise above this height travel comparatively slowly and are sufficiently illuminated by the light reflected from the court, which becomes, under average conditions, a source of an intensity of the order of 2,000 candle-power. The units must not interfere with the play of the ball and their supports must in no way hinder the movements of the players.

There are two systems, the side lighting system and the overhead lighting system, which are applicable to tennis court lighting. In the former, the lighting units are mounted at a moderate height along both sides of the court; in the latter, the units are mounted high above the court, sometimes directly over the court and sometimes between adjacent courts. Many installations are in use today and a number of different varieties of the two systems are employed. However, the requirements of the majority of tennis courts are identical, and a type of installation which has proved itself satisfactory may be applied generally with the certainty that

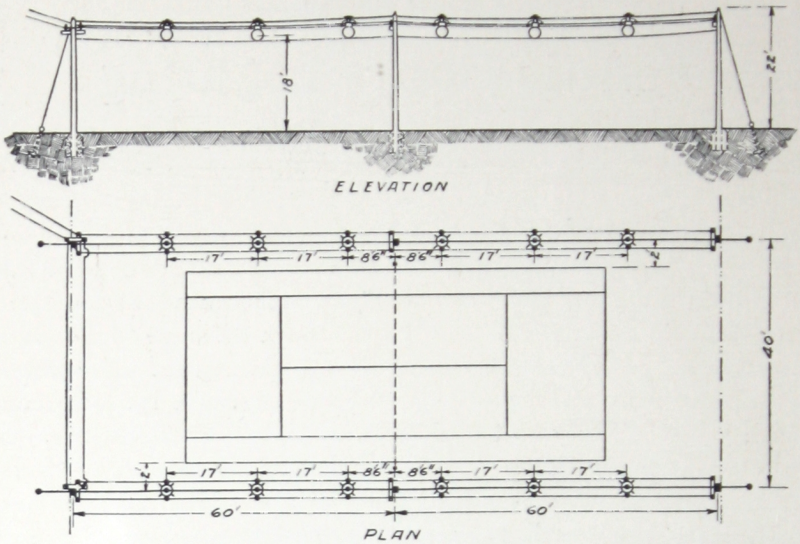


Fig. 1—Side Lighting System

good results will be obtained and with a definite knowledge of the expenditure involved. A thorough study of the best systems has, therefore, been carried on and selections made of those which at the present time give the greatest measure of satisfaction. In the following pages, plans are given for both side lighting and overhead lighting systems. The side lighting system, described first, is particularly adapted to one court. The overhead lighting system, described second, is less expensive to install and is of particular merit when a number of adjacent courts are to be equipped. With certain alterations, mentioned later, this system also may be adapted to one court. In cases where conditions may make it impractical to follow exactly the recommendations given, specifications suited to the peculiar requirements of the court for which lighting is desired will be gladly furnished upon request.

Side Lighting System

Plan and elevation drawings of the side lighting system are shown in Fig. 1. For this system, 12 units are required, 6 located upon each side of the court. They should be located 17 feet apart and 2 feet outside the side lines of the court, and should

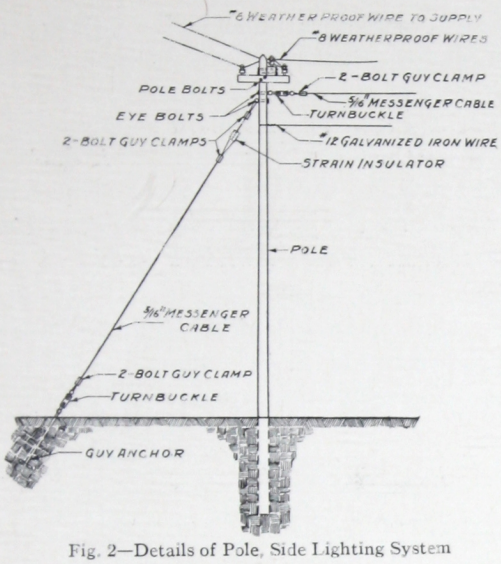


Fig. 2—Details of Pole, Side Lighting System

be suspended at a height which will bring their light centers 18 feet above the ground. If the framework of the side netting is close enough to the court and of sufficient height and strength, the units may be mounted thereon by means of brackets or goose-necks. Usually, however, it is necessary to set poles upon each side of the court and stretch cable between them from which the units may be suspended. Either 2 or 3 poles may be used upon each side, but if only 2 poles are used it is necessary to employ a heavier and more costly construction throughout. Ordinarily, it is well to use 3 poles upon each side of a court; however, if adjacent courts are to be lighted by this system, a single row of poles between two courts will be sufficient for supporting the units for one side of both courts. These may be of wood set in the ground, or iron set in concrete, and should extend at least 22 feet above the ground to allow for the length of the lighting units and the sag in the cable. Galvanized stranded messenger cable, $\frac{5}{16}$ inch in diameter, should be stretched between poles and held taut by means of turnbuckles. The end poles should be guyed by means of $\frac{5}{16}$-inch stranded cable held at the ground end by a

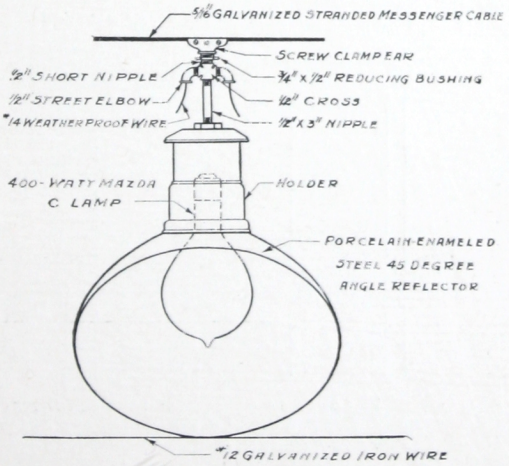


Fig. 3—Details of Unit, Side Lighting System

guy anchor, or "dead man," with a turnbuckle for tightening. Cross arms equipped with pins and insulators should be mounted on the poles to support circuits of No. 8 weatherproof copper wire extending down each side of the court. The main supply circuit should be of at least No. 6 weatherproof copper wire. A double-pole, single-throw switch controlling the entire court should be installed at a convenient height on the pole nearest the source of supply. Details of these arrangements are shown in Fig. 2.

The lighting units should consist of 400-watt MAZDA C lamps fitted with the proper porcelain-enameled steel 45 degree angle reflectors, and holders, as shown in Fig. 3. The units may be conveniently attached to the messenger cable by means of a screw

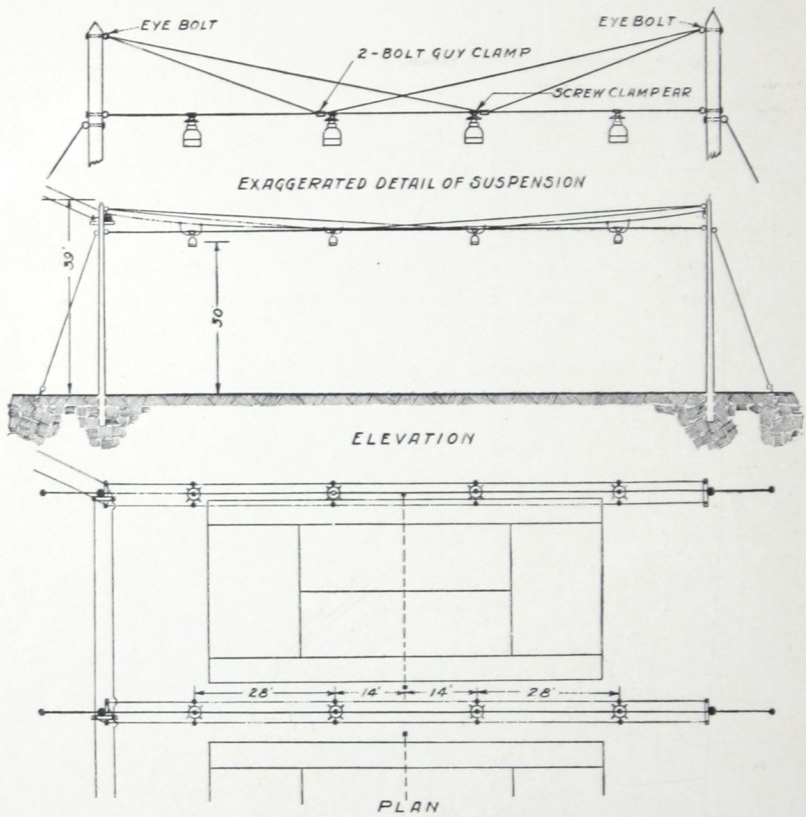


Fig. 4—Overhead Lighting System

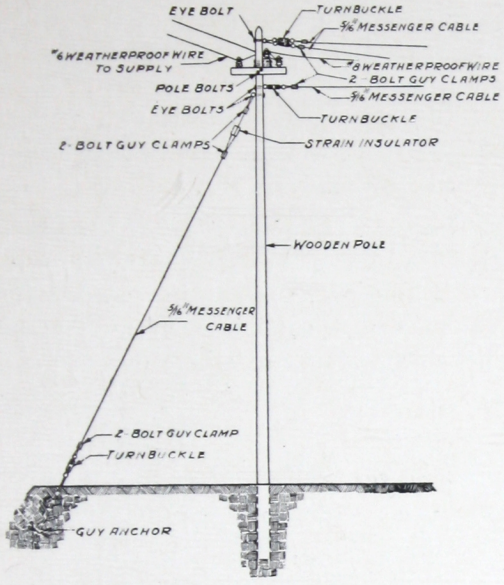


Fig. 5—Details of Pole, Overhead Lighting System

clamp ear and the pipe fittings shown in the drawing. It is desirable to prevent excessive swinging of the units in the wind by stretching galvanized iron wire, No. 12 or larger, between poles at a height corresponding to the lower edge of the reflectors, and tying each reflector to this wire by means of a wire passed through a small hole punched in the rim of the reflector. In many instances it will probably be deemed advisable to protect the lamps from possible breakage. Where this is the case, poultry netting may be stretched over the reflector opening and held in place by means of a band with screw adjustment.

Overhead Lighting System

Figure 4 shows the plan and elevation drawings of the overhead lighting system, which, it will be noted, differs from the side lighting system chiefly in the height and location of the poles and the location, number, and type of lighting units required. In this system, 4 units are needed for each row, and a row should be provided between courts

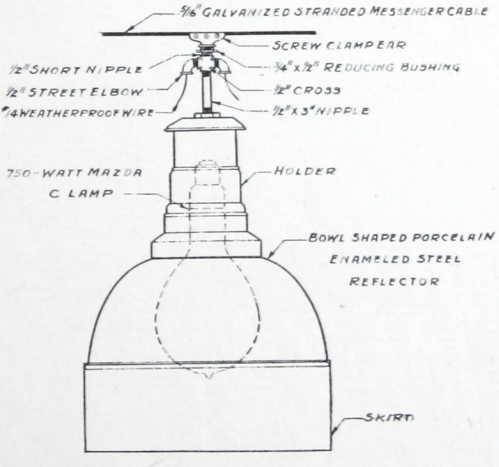


Fig. 6—Details of Unit, Overhead Lighting System

and along the outside edges of the two end courts of the group. The lighting units should be spaced 28 feet apart and suspended so that their light centers will be 30 feet above the court. They should be supported by cable stretched between two 45-foot wooden poles extending at least 39 feet above the ground and guyed after the manner shown in the detail drawing, Fig. 5.

The lighting units should consist of 750-watt MAZDA C lamps fitted with the proper bowl-shaped porcelain-enameled steel reflectors with extension skirts, and holders, as shown in Fig. 6. The units may be attached to the messenger cable in the same manner as described for the side lighting system, or, where expense is a

Table No. 1

Materials Necessary for Side Lighting System

Lamps				
12	400-watt clear MAZDA C lamps	@	$ 4.00 (less 10%)	$43.20
Reflectors and Holders				
12	Porcelain-enameled steel 45-degree angle Reflectors	@	3.00 (less 30%)	25.20
12	Holders	@	2.95 (less 30%)	24.78
Miscellaneous				
6	28-ft. Wooden poles	@	6.50*	39.00
8	Cross arms (2-pin)	@	.32	2.56
16	Pins	@	.04	.64
16	Insulators	@	.03	.48
4	Strain insulators	@	.06	.24
4	Guy anchors	@	1.00	4.00
8	$\frac{5}{16}$" Galv. pipe turnbuckles, hook and eye	@	.50	4.00
16	2-Bolt guy clamps	@	.20	3.20
12	$\frac{1}{2}$" x 8" Eye bolts†	@	.05	.60
16	$\frac{1}{2}$" x 10" Pole bolts†	@	.05	.80
56	Washers	@	.005	.28
360 ft.	$\frac{5}{16}$" Galvanized stranded messenger cable	@	1.25 per C ft.	4.50
260 ft.	No. 12 Galvanized iron wire	@	1.25 per M ft.	.33
500 ft.	No. 8 Weatherproof wire	@	17.25 per M ft.	8.63
200 ft.	No. 6 Weatherproof wire‡	@	25.76 per M ft.	5.15
50 ft.	No. 14 Weatherproof wire	@	6.50 per M ft.	.33
12	Screw clamp ears	@	.22	2.64
12	$\frac{3}{4}$" to $\frac{1}{2}$" Reducing bushings	@	.02	.24
12	$\frac{1}{2}$" Close nipples	@	.04	.48
12	$\frac{1}{2}$" x 3" Nipples	@	.05	.60
12	$\frac{1}{2}$" Crosses	@	.15	1.80
24	$\frac{1}{2}$" Street elbows	@	.10	2.40
1	Double-pole single-throw fused switch			2.00
1	Box for switch			2.00
	Labor			40.00
	TOTAL ESTIMATED COST (Exclusive of bringing service to court)			$220.08

* Steel poles will cost about $15.00 each.

† Length of bolt depends upon size of pole.

‡ Amount depends upon distance to source of supply.

Table No. 2

Materials Necessary per Row of Units for Overhead Lighting System

Lamps				
4	750-watt* clear MAZDA lamps	@	$ 6.00 (less 10%)	$21.60
Reflectors and Holders				
4	Bowl-shaped porcelain-enameled steel Reflectors	@	3.20 (less 30%)	8.96
4	Holders	@	2.95 (less 30%)	8.26
4	Skirts	@	1.70 (less 30-10%)	4.28
Miscellaneous				
2	45-ft. Wooden poles including setting	@	25.00	50.00
3	Cross arms (4-pin)	@	.42	1.26
6	Pins	@	.04	.24
6	Insulators	@	.03	.18
2	Strain insulators	@	.06	.12
2	Guy anchors	@	1.00	2.00
8	5/16″ Galv. pipe turnbuckles, hook and eye	@	.50	4.00
14	2-Bolt guy clamps	@	.10	1.40
6	1/2″ x 12″ Eye bolts†	@	.06	.36
6	5/8″ x 14″ Pole bolts†	@	.06	.36
24	Washers	@	.005	.12
450 ft.	5/16″ Galv. stranded messenger cable	@	1.25 per C ft.	5.63
250 ft.	No. 8 Weatherproof wire	@	17.25 per M ft.	4.31
100 ft.	No. 6 Weatherproof wire‡	@	25.76 per M ft.	2.58
20 ft.	No. 14 Weatherproof wire	@	6.50 per M ft.	.13
4	Screw clamp ears	@	.22	.88
4	3/4″ to 1/2″ Reducing bushings	@	.02	.08
4	1/2″ Close nipples	@	.04	.16
4	1/2″ x 3″ Nipples	@	.05	.20
4	1/2″ Crosses	@	.15	.60
8	1/2″ Street elbows	@	.10	.80
1	Double-pole single-throw fused switch			2.00
1	Box for switch			2.00
	Labor			25.00
	*TOTAL ESTIMATED COST PER ROW OF UNITS (Exclusive of bringing service to court)			$147.51

* In the case of only one court, 1000-watt clear MAZDA C lamps should be used in place of 750-watt lamps. This increases the total estimated cost to $153.91.

† Length of bolt depends upon size of pole.

‡ Amount depends upon distance to source of supply.

Table No. 3

Estimated Cost of Overhead Lighting System for a Group of Courts Exclusive of Bringing Service to Court

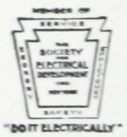
	Total Cost	Cost Per Court
Two Courts	$442.53	$221.27
Three Courts	590.04	196.68
Four Courts	737.55	184.39
Five Courts	885.06	177.01
Six Courts	1032.57	172.09

secondary consideration, the units may be equipped with automatic cut-out hangers in order that they may be lowered to facilitate the replacement of lamps. Since the units are suspended 30 feet above the court, there is little danger of breakage, but, if desired, the lamps can be protected by poultry netting in the manner previously described.

In case it is desired to adapt the overhead system to one court, it is only necessary to use a single row of units over the center line of the court in place of the two side rows. The lighting units should be of the same type as for adjacent courts, but should be of the 1000-watt size.

Installation Cost

In order that those interested may obtain an idea of the expense involved, Tables 1, 2, and 3, based on estimated prices, have been included in this bulletin. They are arranged so that it is a simple matter to substitute known local prices for the estimated prices as given and to arrive closely at the actual cost. Due to the fact that the cost of bringing service to a court is dependent wholly upon local conditions, it has not been thought advisable to include a figure for this cost in the estimates given.



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